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**ENGLISH TRANSLATION OF ANNEX
TO INTERNATIONAL PRELIMINARY
EXAMINATION REPORT OF
PCT/EP2003/010144**

Method and device for the detection of at least one luminescent substance

This invention relates to a device for the detection of at least one luminescent substance, with a radiation source for the emission of excitation radiation to the at least one luminescent substance, whereby the excitation radiation has at least one excitation wavelength at which the luminescent substance is excited to emit luminescent radiation, and with at least one radiation receiver which is insensitive to the excitation radiation for the detection of the luminescent radiation, whereby the luminescent substance is located in the interior of a measurement chamber which is essentially impermeable to the radiation to which the radiation receivers are sensitive, and whereby the radiation source is located outside the measurement chamber such that the excitation radiation is injected through a wall area of the measurement that faces the radiation source and is transparent for the excitation radiation through the measurement chamber into the interior of the measurement chamber.

A similar device of the prior art is described in EP-A-0 640 828. It has a measurement chamber which has a wall area that is formed by a dichroitic mirror, behind which, outside the measurement chamber, a radiation source is located which emits an excitation radiation through the wall area at a wavelength of approximately 302 nm (UV) into the measurement chamber. In the interior of the measurement chamber, a plurality of reaction vessels are provided, in which samples are located that are marked with a luminescent substance. The luminescent substance is excited by the excitation radiation to emit a luminescence radiation, the wavelength of which is different from that of the excitation radiation. The measurement chamber is impermeable for the luminescent radiation. For the detection of the luminescent radiation, a CCD camera is located in the measurement chamber at some distance from the samples. This device of the prior art has a relatively complicated construction.

A device of the prior art described in US-A-4 868 103 has a flashlamp as the radiation source and a photomultiplier tube as the radiation receiver. Between the radiation source and a sample that contains a luminescent substance to be tested on one hand, and between the sample

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and the radiation receiver on the other hand, there are respective optical interference filters. This device of the prior art is therefore correspondingly expensive.

US-A-5 885 843 describes another device of the prior art with a measurement chamber in which a photoluminescence aerogel is located. As the radiation source, outside the measurement chamber a UV lamp is provided which emits UV radiation into the measurement chamber through an optical filter. The UV radiation excites the photoluminescent aerogel to emit visible luminescent light which is detected with a photodiode. To prevent the light emitted by the radiation source from reaching the photodiode, the optical filter is impermeable to the luminescent light. This device of the prior art also has a relatively complicated construction.

The object of the invention is therefore to create a device of the type described above which, with a simple and compact construction.

This invention teaches that the wall area is formed by a semiconductor substrate, and that the at least one radiation receiver is integrated in the form of a semiconductor component into the semiconductor substrate.

The semiconductor substrate thereby advantageously performs a dual function, and in addition to acting as the support for the at least one radiation receiver, also acts as a window for the injection of the excitation radiation into the measurement chamber. The measurement chamber can then be manufactured particularly economically using microsystems engineering methods. The device can thereby have very compact dimensions. The measurement chamber shields, in the wavelength range that can be detected with the radiation receiver, the at least one radiation receiver that is located in the measurement chamber or within its external contour against scattered or spurious radiation that occurs outside the measurement chamber. Any spurious radiation that penetrates into the wall of the measurement chamber is thereby either completely extinguished or is at least so severely attenuated that after it penetrates the wall it is practically no longer detected by the radiation receiver. Thus, in the wavelength range to be detected, the measurement has a high level of protection against interference from scattered or spurious radiation.

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The device can optionally also be used as an optical coupler. In that case, the radiation source for the transmission of a signal can be connected with a modulation device device [sic] and the radiation receiver can be connected with a demodulation device. The term "luminescence" as used here means all emissions of radiation quanta, primarily luminous phenomena such as fluorescence or phosphorescence, that substances exhibit after quantum excitation.

In one advantageous configuration of the invention, the semiconductor substrate is a silicon substrate. Silicon is permeable for infrared light at a wavelength of greater than approximately 1080 nm, which means that the radiation source for the excitation of the luminescent substance can be provided in the form of an infrared radiation source. The radiation receiver can be a silicon photodiode that is integrated into the semiconductor substrate and is insensitive in this wavelength range.

In one particularly advantageous realization of the invention, the device is realized in the form of a thermal imaging camera which has a plurality of radiation receivers arranged in the measurement chamber, preferably in the form of a two-dimensional matrix, associated with at least one of which receivers is an optical imaging system for the imaging of the radiation source on the radiation receiver. In this case, in the interior of the measurement chamber, there can be a layer of luminescent substance that extends continuously over the radiation receiver. It is also conceivable, however, that the layer of luminescent substance has interruptions between the radiation receivers. The layer of luminescent substance can optionally occupy all of the space between the walls of the measurement chamber located one on either side of the layer of luminescent substance, i.e. the walls form a laminated stack with the layer of luminescent...

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